KTU-GEOD IVS Analysis Center Annual Report 2012

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Abstract

This report summarizes the activities of the KTU-GEOD IVS Analysis Center (AC) in 2012 and outlines planned activities for 2013. The analysis of the EUROPE sessions is one of our specific interests, and the combination of different AC solutions for continuous VLBI campaigns, e.g. CONT11, will be investigated.

1. General Information

The KTU-GEOD IVS Analysis Center (AC) is located at the Department of Geomatics Engineering, Karadeniz Technical University, Trabzon, Turkey.

Figure 1. KTU-GEOD staff at Vienna State Opera.

2. Staff at KTU-GEOD

The staff who are contributing to the research at the KTU-GEOD IVS Analysis Center (AC) in 2012 are listed in Table 1 with their main focus of research and working location.

3. Current Status and Activities

In 2012, we investigated sub-daily (three-hour) antenna TRF coordinates estimated from the VLBI observations of the continuous 24h sessions of the CONT11 campaign [8]. We analyzed VLBI observations using the Vienna VLBI Software (VieVS) which is developed at the Department of Geodesy and Geoinformation at the Vienna University of Technology [2]. Troposphere zenith wet delays (ZWD) and total gradients (east and north) were estimated as piecewise linear offsets at one hour and six hours, respectively. Clock errors were estimated as hourly piecewise linear offsets, in addition to as quadratic polynomials. Source coordinates were fixed to ICRF2 [3]. The IERS

Table 1. Staff members of KTU-GEOD ordered alphabetically.

Name	**Working location**	**Main focus of res.**	**Contact**
Emine Tanır Kayıkçı	Karadeniz Technical University, Dept. of Geomatics Engineering, Trabzon, Turkey	Responsibility for the Analysis Center and data processing	etanir@ktu.edu.tr
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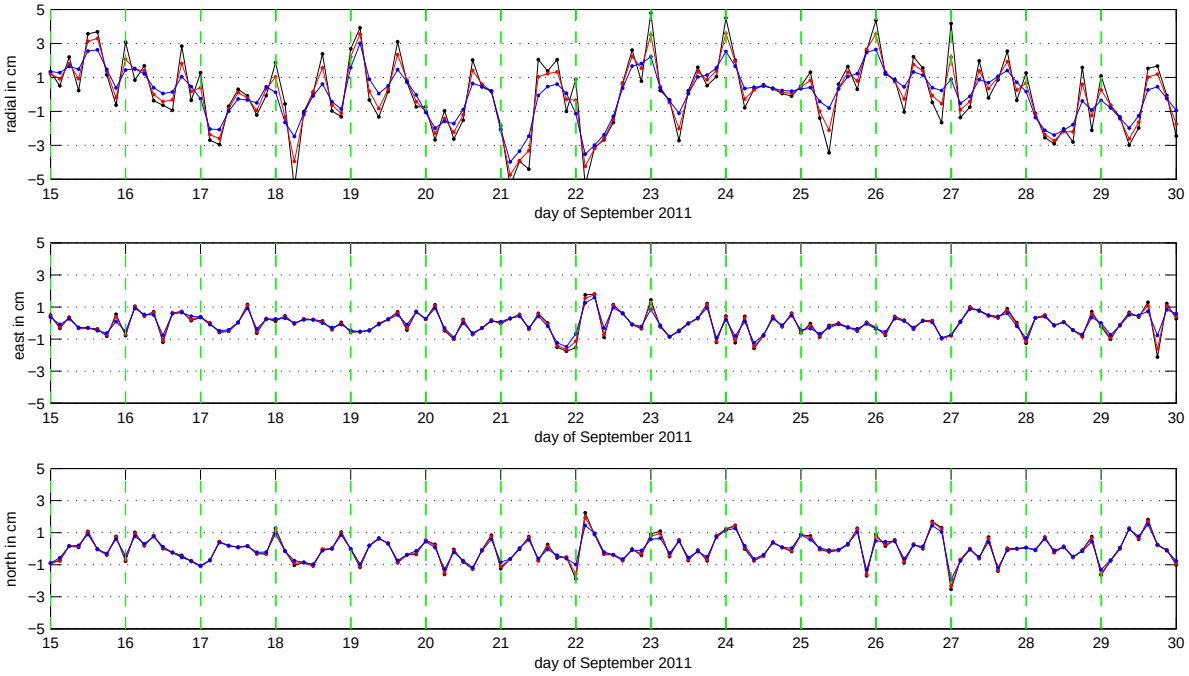

Figure 2. Kokee VLBI antenna piecewise (pw) coordinate offsets at three-hour intervals. Weighted means of pw coordinate offsets were calculated at the overlapping 24h session boundaries. The black, red, and blue dotted lines denote the pw coordinate estimates when loose relative constraints of 5 cm, 2 cm, and 1 cm after three hours were imposed [8].

C04 08 series [1] was taken as a priori values of Earth Orientation Parameters, and high frequency ocean tidal corrections were modeled as recommended by the IERS Conventions 2010 [5]. Earth orientation parameter residuals were estimated as one offset per 24-hour VLBI session. An a priori TRF was estimated from a global solution of CONT11 where antenna velocities were fixed to those of VTRF2008. In the global solution, TRF datum condition equations were introduced on the accumulated datum-free normal equation system in such a way that the estimated TRF had no-net-translation (NNT) and no-net-rotation (NNR) with respect to VTRF2008. Atmospheric loading [6] and tidal ocean loading corrections (FES2004, [4]) to the antenna coordinates were

introduced for each observation before the adjustment. All the antenna coordinates were fixed to the TRF (from global solution) except for one antenna whose coordinates were estimated as piecewise linear offsets at three-hour intervals. Different loose relative constraints on the coordinate estimates of this one antenna were imposed for each analysis of the CONT11 campaign as: 5 cm, 2 cm, and 1 cm after three hours (see Figure 2). Readers are referred to [7] and [10] for more information on the analysis of VLBI observations.

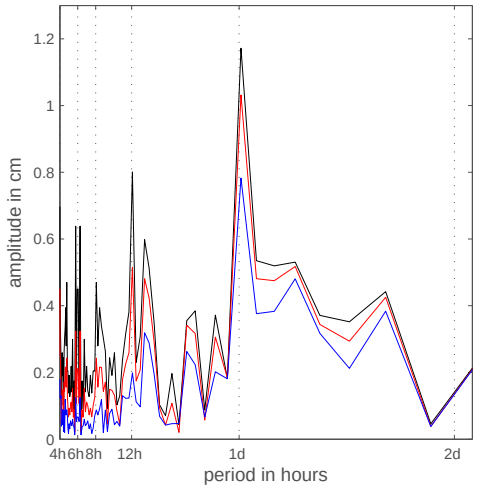

Figure 3. Fourier spectra of piecewise (pw) coordinate offsets on radial direction at three-hour intervals at Kokee. The black, red, and blue dotted lines denote the pw coordinate estimates when loose relative constraints as 5 cm, 2 cm, and 1 cm after three hours were imposed [8].

The reasons for large unrealistic leaps of three-hour antenna coordinates, especially for radial components, are investigated (e.g., shown for Kokee in Figure 2). One of the possible reasons might be the large correlation between certain parameters (e.g., clock errors, troposphere delays, source coordinates, and Earth rotation parameters) and antenna coordinates at sub-daily intervals. Another possible reason might be the unreduced tidal effects on the antenna coordinates. In this case, one might ask whether the radial amplitudes of the tidal variations can reach up to 1 cm (see black and red lines at one-day period in Figure 3) even though antenna coordinates are corrected at each observation epoch using state-of-the-art geodynamic models. The correct answer to this question needs further investigation. In Figure 3, the significant amplitude of 8 mm at 12 hours (black line) vanishes when 1 cm after 3h relative constraint (blue line) was imposed in the analysis. Thus, selecting really loose constraints is essential in order to not hide the dependencies (shared variances) between parameters in the observation equations. Further investigations are discussed in [8].

4. Future Plans

We will continue to analyze VLBI sessions with different parameterizations, focusing on the EUROPE sessions by using VieVS. In 2013, we will study intra-technique combination of different AC solutions of the continuous VLBI campaigns, i.e. CONT02, CONT05, CONT08, and CONT11.

Besides, we will do statistical comparisons between certain geodetic parameters, e.g. troposphere [9].

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